

IX. *On the Modifications of Æstivation observable in certain Plants, formerly referred to the Genus Cinchona.* By Mr. DAVID DON, Libr. L.S.

Read April 2nd, 1833.

THE various forms of æstivation appear to depend, in a great measure, on the relative position and development of the organs of reproduction; for we have remarked that the valvate kind occurs most frequently in such flowers as have those organs much enlarged and projecting beyond the mouth of the tube of the corolla, or where there exists any considerable inequality in length between the stamina and pistillum. It is much more varied in monopetalous than in polypetalous flowers; for, with the exception of a portion of the *Rutaceæ*, principally from New Holland and South America, the imbricate form is found generally to prevail in the latter class. In the valvate form the pieces, having their edges sloped in opposite directions, are nicely fitted together, affording not only the most complete protection to the delicate organs within, but also ample space for the development and subsequent impregnation of the stigma.

Among the monopetalous orders the form of æstivation is a character of such high value as oftentimes to afford the only palpable distinction to the limitation of families; but the extensive order *Rubiaceæ* presents a striking exception, examples of almost every modification of æstivation being afforded by it. The *Rubiaceæ* appear to constitute a grand central point of union (of which several may be remarked in the vegetable kingdom,) between the families of the monopetalous class; and possessing great diversity of form and character, they are found to partake more or less of the habit and structure of those orders to which they are related. The *Rubiaceæ* are intimately allied on the one hand to *Caprifoliaceæ* and *Valerianeæ*, and on the other to *Apo-cynææ* and *Gentianeæ*, being distinguished from the two former by their symmetrical flowers, and from the latter by their adherent ovarium and undivided

style. All these families agree in having for the most part opposite and perfectly entire leaves.

As has already been remarked, the *æstivation* of corolla does not afford any permanent distinction between those families and *Rubiaceæ*; for in *Gardenia* we have the convolute *æstivation* of *Apocynææ*, and the valvate and imbricate forms of *Caprifoliaceæ* and *Valerianææ* occur in many genera of *Rubiaceæ*, and examples of each variety are to be found even in the species formerly included under *Cinchona*; thus, for example, in the *Cinchona grandiflora* and *rosea* of the *Flora Peruviana* it is imbricate, in *C. lanceolata* and the rest of the true *Cinchonæ* it is valvate, while in the West Indian species it is induplicate, and plaited in the *C. excelsa* of Roxburgh.

These variations of *æstivation* being found connected with other differences in structure, appear fully sufficient to entitle the abovementioned species to be regarded as constituting the types of so many distinct genera, the characters of which I shall now proceed to give.

CINCHONA.

CINCHONÆ SP. *Auctt.*

Calyx 5-dentatus. *Corolla* tubulosa, limbo 5-loba, *æstivatione* valvatâ. *Antheræ* lineares, semiexsertæ. *Stigma* bilobum. *Capsula* bilocularis, septicido-dehiscens, polysperma. *Semina* peltata, samaroidea, margine membranaceo lacero.

Arbores (Amer. Merid.) *inflorescentiâ paniculatâ*.

* *Dehiscentiâ basilari*. Sp. normales.

1. *C. lanceolata*. *Ruiz et Pavon*. (*Condaminea Humb. et Bonpl.*)
2. *cordifolia*. *Mutis*.
3. *rotundifolia*. *Lamb. Ill. Cinch.*
4. *ovalifolia*. *Humb. et Bonpl.*
5. *purpurea*. *Ruiz et Pavon*.
6. *pubescens*. *Vahl*.
7. *micrantha*. *Ruiz et Pavon*.
8. *Humboldtiana*. *Lamb. l. c.*
9. *glandulifera*. *Ruiz et Pavon*.
10. *hirsuta*. *Ruiz et Pavon*.
11. *stenocarpa*. *Lamb. l. c.*
12. *caudiciflora*. *Humb. et Bonpl.*

** *Dehiscentiâ terminali*. Sp. aberrantes.

13. *macrocarpa*. *Vahl*.
14. *oblongifolia*. *Mutis*.
15. *magnifolia*. *Ruiz et Pavon*.
16. *Pavonii*. *Lamb. l. c.*
17. *acutifolia*. *Ruiz et Pavon*.

In several species of the normal group of this genus the inner surface of the corolla is lined with a thick coat of hairs, analogous to the *pili collectores* which cover the branches of the style and the upper surface of the lobes of the corolla in many *Compositæ*.

COSMIBUENA. *Ruiz et Pavon.*

BUENA. *Persoon et DeCand.*

CINCHONÆ SP. *Auctt.*

Calyx 5-dentatus. *Corolla* tubulosa, limbo 5-loba, æstivatione imbricatâ. *Antheræ* oblongæ, exsertæ. *Stigma* bipartitum. *Capsula* subquadrilobularis, ab apice dehiscens, polysperma. *Dissepimenta* e duplici valvarum margine revoluto seminifero constituta. *Semina* peltata, angusta, ramentacea, extremitatibus fibrosis.

Arbores (Amer. Merid.) *inflorescentid cymosâ*.

1. *C. obtusifolia*. *Ruiz et Pavon.* 2. *acuminata*. *Ruiz et Pavon.*

In *Buena hexandra* of Pohl, which M. De Candolle has retained in this genus, the æstivation of corolla is valvate, and the structure of the capsule apparently the same as in *Cinchona*, to which I am disposed to refer it. Whether, as Pohl has suggested, the *Cinchona dichotoma* of Ruiz and Pavon ought to be referred to the present genus I am unable to decide, the specimens being without flowers, as represented in the plate of the *Flora Peruviana*, although the structure of the capsule is pretty nearly similar to that of *Cosmibuena*.

Having had no opportunity of examining any species of M. De Candolle's *Remijia*, I am uncertain whether it is entitled to be regarded as a distinct genus; but if it should prove different, other characters than those mentioned by that celebrated botanist must be looked for to distinguish it from *Cinchona*, as the peltate seeds are common to most of the genera now under consideration, and the description of the dehiscence of the capsule appears to have originated in a misconception of the account given by M. Auguste de St. Hilaire.

LACIONEMA.

CINCHONÆ SP. *Auctt.*

Calyx 5-dentatus. *Corolla* tubulosa, limbo 5-loba, *æstivatione* imbricatâ. *Stamina* exserta : *filamenta* medio barbata : *antheræ* subrotundæ, peltatæ : *loculis* basi solutis. *Stigma* bilobum. *Capsula* bilocularis, medio loculicido-dehiscens, polysperma : *septo* completo. *Semina* peltata, exigua, samaroida.

Arbor (peruviana) *inflorescentiâ* paniculatâ.

1. *L. roseum*.

Cinchona rosea. *Ruiz et Pavon, Fl. Peruv. et Chil.* ii. p. 54. *tab.* 199. *Lamb. Ill. Cinch.* p. 15.

EXOSTEMA. *Persoon.*CINCHONÆ SP. *Auctt.*

Calyx 5-dentatus. *Corolla* tubulosa, limbo 5-partita : *laciniis* lineari-elongatis, *æstivatione* induplicatis. *Stamina* exserta. *Antheræ* angustè lineares : *loculis* basi adnatis. *Stigma* indivisum. *Capsula* bilocularis, ab apice septicido-dehiscens, polysperma. *Semina* peltata, margine membranaceo integerrimo.

Arbores (præcipuè Ind. Occid.) *inflorescentiâ* cymosâ.

1. *E. floribundum*. 2. *caribæum*. 3. *longiflorum*. 4. *corymbiferum*. 5. *angustifolium*. 6. *brachycarpum*. 7. *triflorum*.

HYMENODICTYON. *Wall.*CINCHONÆ SP. *Rorb.*

Calyx 5-dentatus. *Corolla* tubulosa, limbo 5-fida, *æstivatione* plicatâ. *Antheræ* lineares, exsertæ. *Stigma* bilobum. *Capsula* bilocularis, loculicido-dehiscens, polysperma : *valvis* ventricosis, membranaceis. *Dissepimentum* completum. *Semina* peltata, membranaceo-alata.

Arbores (Ind. Orient.) *inflorescentiâ* paniculatâ.

1. *H. excelsum*. *Wall.* 2. *thyrsiflorum*. *Wall.*

LUCULIA. *Sweet.*

CINCHONÆ SP. *Wall.*

MUSSÆNDÆ SP. *Don, Prodr. Fl. Nep.*

Calyx 5-partitus: *laciniis* foliaceis. *Corolla* tubulosa, limbo 5-loba, æstivatione imbricatâ. *Stamina* subinclusa. *Antheræ* lineares. *Stigma* bipartitum. *Capsula* bilocularis, ab apice septicido-dehiscens, polysperma. *Semina* peltata, samaroidea, margine membranaceo lacero.

Arbores (nepalenses) *inflorescentiâ cymosâ, bracteâtâ.*

1. *L. gratissima.* *Sweet.* (*Cinchona Wall.*).
2. *cuneifolia* (*Mussænda Prodr. Fl. Nep.*).

PINCKNEYA. *Mich.*

CINCHONÆ SP. *Poir.*

Calyx 5-partitus; *laciniâ alterâ maximâ, foliaceâ, coloratâ.* *Corolla* tubulosa, limbo 5-fida, æstivatione valvatâ. *Stamina* exserta. *Antheræ* peltatæ. *Stigma* emarginatum. *Capsula* bilocularis, septicido-dehiscens. *Semina* compressa, margine membranaceo-alata, basi emarginatâ inserta.

Arbor (Amer. Bor.) *inflorescentiâ cymosâ, bracteolatâ.*

1. *P. pubeus.* *Mich.*

It will be seen that the æstivation of corolla affords an important mark in distinguishing these groups, which are well defined and very natural. So little has this character been attended to among the *Rubiaceæ*, that even the illustrious Humboldt has included *Lasionema* among the synonyms of his *Cinchona Condaminea*, and M. De Candolle, who appears to have seen samples of it, still continues to place it in that genus, from which it is widely different, not only in the imbricate æstivation of its corolla, but also in the structure of the stamens and dehiscence of its capsule. The plate in the *Flora Peruviana* is a very faithful likeness of the plant, the structure of the stamens and the æstivation of corolla being there correctly represented.